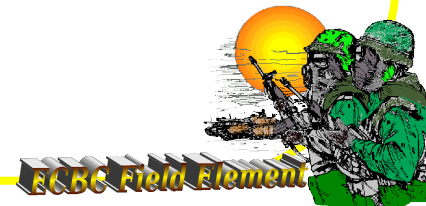


# The Economics of Modeling & Simulation

## Modeling & Simulation Return on Investment (ROI) "Real Savings" Vs. Indirect Savings and Cost Avoidance

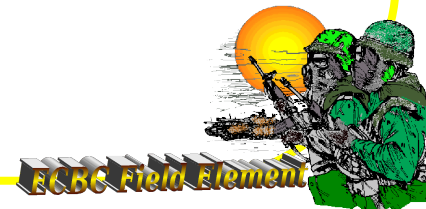


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## Agenda

- Discuss role of modeling and simulation (M&S) in supporting U.S. Army decision process
- Describe an example application of M&S which returns both direct and indirect economic returns
- Discuss methods used to translate the indirect measures into returns
- Discuss calculation of the overall ROI and its' role in assessing the value added of M&S
- Describe overall M&S impact on the decision making process

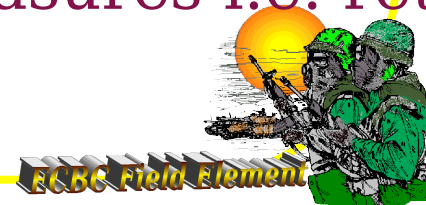


# Introduction

- The Department of Defense (DoD) acquisition process is undeniably complex.

**“The process is executed as a result of the worth while desire to ensure the best possible expenditure of public funds in pursuit of goals deemed to be in the public's best interest.”**

- Current emphasis is on adapting commercial “best practices” to the military acquisition process.
- A major part of this emphasis is the adaptation of:
  - The use of modeling and simulation (M&S)
  - The use of standard financial measures i.e. return on investment (ROI)



## Assumptions . . .

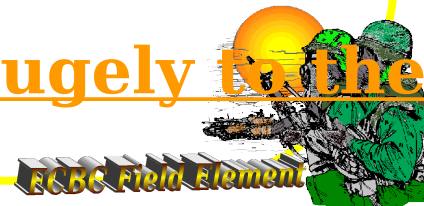
- ☛ Today's military decisions can be classified as "interdependent decision processes".

1. Newman, Donald G. 1991. Engineering Economic Analysis. Engineering Press Inc., San Jose, CA.

- They involve many factors
  - Economics is paramount
- ☛ In this context, if a benefit of an investment cannot be expressed as an economic return, it may be traded-off for "real savings".
- ☛ Indirect factors such as:
  - Improved design
  - Better performance
  - Increased survivability

Must be translated into measures that can be expressed as a return on investment (ROI).

**These indirect factors contribute hugely to the**



# A Production Company Vs. The Military

## The Military

The military makes investments to develop, build, maintain, operate, support, and in many cases, retire the item at the end of its service life.

**“Service life” related returns are less quantifiable**

**and the return on improvements made in these areas will often be very large and occur over a long service life.**

A production company makes investments to develop, build, and sell a product. Once the sale is made, it is up to the buyer to maintain, operate and support the item during its service life.

The dollars invested to develop, build and sell an item are easily measured by tracking its budget over time. The short-term returns on these investments are relatively easily estimated.



## A Production Company

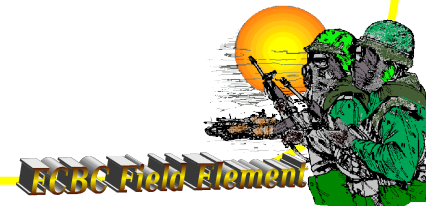


## Using Modeling & Simulation

- Obtaining critical estimates of less tangible returns in the acquisition process when the investments need made
- Gaining acceptance by the acquisition community
- Impacting program decision points by providing key information otherwise not available
- Becoming, in itself, an investment and an intangible providing “positive” ROI to an acquisition effort
- Providing re-use capability or follow-on ROI

the critical question to be answered by decision-makers

“What will it buy me?”

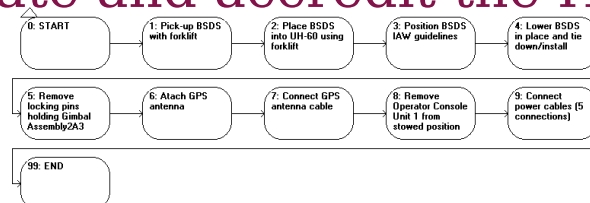


# M&S Application

## Nuclear, Biological and Chemical Reconnaissance System (NBCRS)



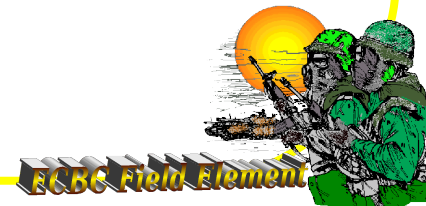
- Operational testing concluded that a 3-man crew could not operate NBCRS effectively because vehicle and workstation design was not
- The Army Research Laboratory (ARL) developed a corrective action
  - Human figure modeling - Crew-station suitability
  - HARDMAN III modeling - Operational mission task performance
  - Operational Validation Test - Validate M&S predictions
- These results confirmed the HARDMAN III model estimates of mission performance
- Within 6 months the system was adopted for fielding
- Test data was used to update and accredit the HARDMAN III model use





## Translating Indirect Benefits into R

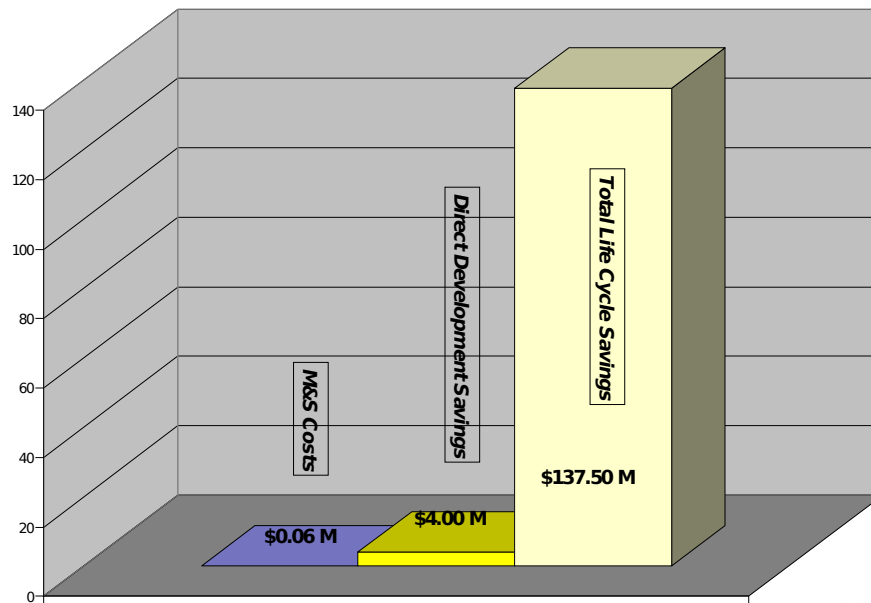
- Direct returns can be found by performing a relatively simple cost and benefits analysis
- Indirect or intangible benefits are a much different and difficult challenge
- The methodology chosen to answer this challenge for the described M&S application used Process Modeling (PM) by Activity Based Costing (ABC)
- The PM-ABC methodology allows the analyst to attach costs to the identified activities and to convert indirect returns into economic measures
- PM-ABC provides the secondary benefit of creating a model of the process being analyzed, which may be useful beyond the cost focus





## Estimating ROI

- The ARL M&S effort cost was \$60 K over a period of
- ARL's use of M&S in its corrective action plan resulted in direct savings ROI (minimized contract modification and impact reduction) of 66.67 ( $\text{ROI} = \text{return}/\text{cost}$ ,  $66.67 = \$4 / \$0.06$ )
- Intangible returns (MPT savings) over the service life estimated to be in excess of ***\$137.5 M for a ROI of 22.***



## M&S Impact on Decisions

- This application of M&S clearly illustrates:
  - ♦ Direct cost and schedule savings in real dollars
  - ♦ Illustrates that the largest ROI to be calculated resides in the intangible savings related to reduced manpower, personnel and training burden over the systems service life
- The PM-ABC methodology has proven its value as a tool for estimating ROI
- This example illustrates the level of PM-ABC acceptance
- These ROI calculating methods played a key role in the acquisition decision making process
- As a result of achieving a “positive” ROI the M&S efforts have been verified, validated and accredited for use in support of future NBC reconnaissance systems

